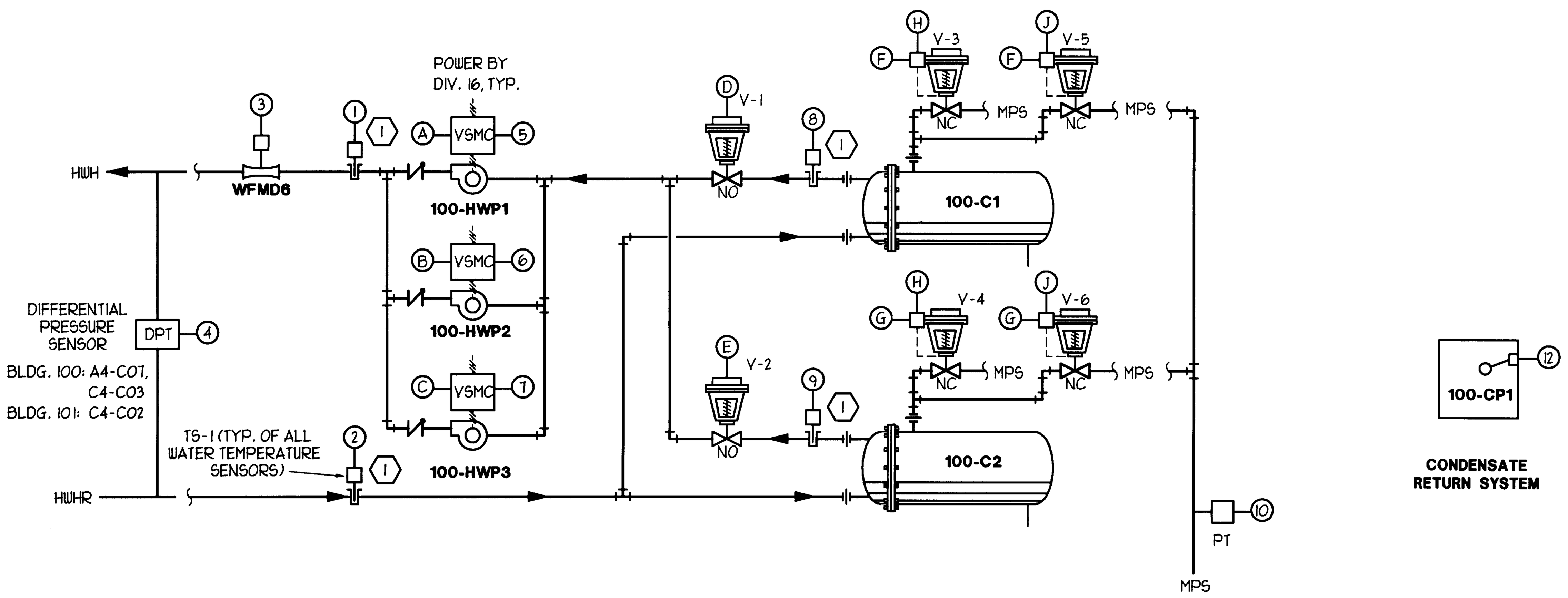
HEATING WATER CONTROL LEGEND

DESIGNATION	DESCRIPTION	FUNCTION
PT	STEAM PRESSURE TRANSMITTER	SENSES AND TRANSMITS STEAM PRESSURE TO DCP
TS-1	WATER TEMPERATURE SENSOR W/STAINLESS STEEL WELL	SENSES AND TRANSMITS HOT WATER TEMPERATURE TO DCP
V-1, V-2	2 POSITION HOT WATER VALVE	ISOLATES INACTIVE CONVERTER
V-3, V-4	MODULATING CONTROL STEAM VALVE	REGULATES STEAM FLOW TO CONVERTER
V-5, V-6	FLOATING CONTROL STEAM VALVE	CHANGES STEAM FLOW TO CONVERTER WHEN "V-3, V-4" IS EITHER FULL OPEN OR CLOSED (VERNIER CONTROL)

RESET SCHEDULE

O/A TEMP °F	WATER TEMP °F
30	180
40	180
50	170
60	160
70	150
80	140
90	140



HOT WATER HEATING SYSTEM TEMPERATURE CONTROL & FLOW DIAGRAM

ENGINEERING CONTROL CENTER (ECC) INPUT/OUTPUT SCHEDULE

GENERAL / HARDWARE – OUTPUTS

	QUANTITY REQUIRED	DIAGRAMMATIC GRAPHICS	CONTROL RELAY (START/STOP) (DIGITAL)	RESET TEMPERATURE SETPOINT (ANALOG)	POSITION ADJUSTMENT/SPEED (ANALOG)	RESET PRESSURE SETPOINT (ANALOG)
HEATING WATER SYSTEM	1	X				
HWP-1, HWP-2 & HWP-3 (VSMC)	3				X	
HWH	1					
HWHR	1					
HWH PRESSURE SENSOR (DPT)	2					
MODULATING (VERNIER) STEAM VALVES	2		X		X	
FLOATING STEAM VALVES	2		X		X	
CONVERTER HWH	2					
CONVERTER STEAM SUPPLY	1		X			
DDC EMERGENCY BYPASS	1					
CONDENSATE RETURN PUMPS	2					

HARDWARE – INPUT

	PRESSURE SWITCH	DIFFERENTIAL PRESSURE SWITCH	DIRECTIONAL FLOW SWITCH	CURRENT SWITCH	POSITION INDICATOR	FLOAT SWITCH	AUXILIARY CONTACT	RELAY CONTACT	BACK-UP STATUS CONTACT	ALARM CONTACT	TEMPERATURE °F	% RELATIVE HUMIDITY	PRESSURE	KW	POSITION	FLOW SENSOR (GPM - LBS/HR.)	DIFFERENTIAL PRESSURE
HEATING WATER SYSTEM																	
HWP-1, HWP-2 & HWP-3 (VSMC)														X			
HWH											X					X	
HWHR											X						
HWH PRESSURE SENSOR (DPT)																	X
MODULATING (VERNIER) STEAM VALVES																	
FLOATING STEAM VALVES																	
CONVERTER HWH											X						
CONVERTER STEAM SUPPLY											X		X				
DDC EMERGENCY BYPASS																	
CONDENSATE RETURN PUMPS						X	X										

(Input columns PRESSURE SWITCH through ALARM CONTACT are DIGITAL; TEMPERATURE °F through DIFFERENTIAL PRESSURE are ANALOG.)

SOFTWARE – ALARMS

	STATUS ABNORMAL	RESERVE SWITCHOVER	WATER QUALITY	DDC BYPASSED	HIGH LIMIT	LOW LIMIT	LOW LIQUID LEVEL
HEATING WATER SYSTEM							
HWP-1, HWP-2 & HWP-3 (VSMC)	X						
HWH					X	X	
HWHR							
HWH PRESSURE SENSOR (DPT)					X	X	
MODULATING (VERNIER) STEAM VALVES							
FLOATING STEAM VALVES							
CONVERTER HWH					X	X	
CONVERTER STEAM SUPPLY					X	X	
DDC EMERGENCY BYPASS				X			
CONDENSATE RETURN PUMPS	X				X		X

(Alarm columns STATUS ABNORMAL through DDC BYPASSED are DIGITAL; HIGH LIMIT through LOW LIQUID LEVEL are ANALOG.)

SOFTWARE – APPLICATION PROGRAMS / REMARKS

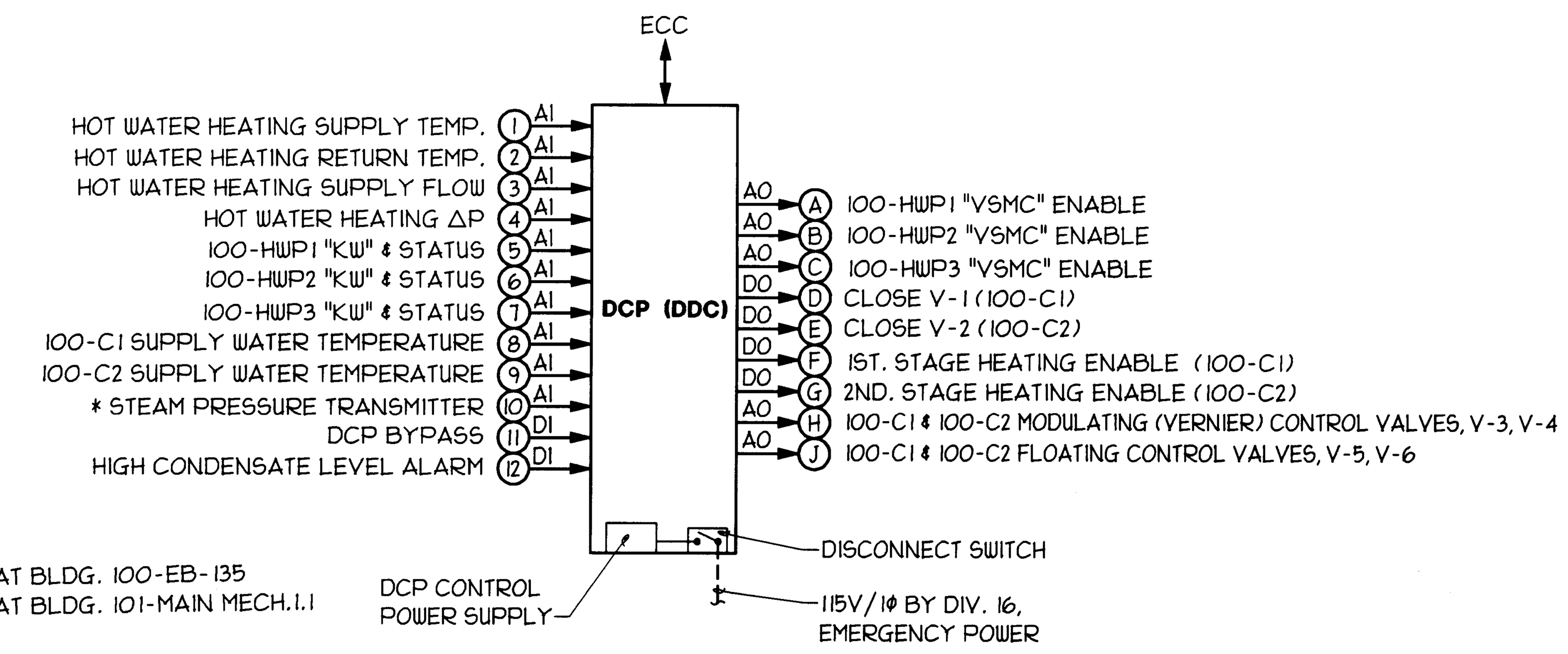
	SCHEDULED STOP START	OPTIMUM START STOP	DUTY CYCLING	ELECTRIC DEMAND LIMITING	AUTOMATIC RESTART	CHW PLANT OPERATION/OPTIMIZATION	C.T. OPERATION/OPTIMIZATION	CHW PLANT PERFORMANCE RECORDS	KW/TON	HEATING WATER OPERATION	EVENT INITIATED PROGRAM	PREVENTIVE MAINT. INSTRUCTIONS	RUN TIME	BTU CALCULATION	REMARKS
HEATING WATER SYSTEM															
HWP-1, HWP-2 & HWP-3 (VSMC)	X	X			X					X	X	X	X		PUMPS ENABLED THRU. ANALOG INPUTS
HWH										X				X	
HWHR										X				X	
HWH PRESSURE SENSOR (DPT)										X					
MODULATING (VERNIER) STEAM VALVES										X	X				V-3, V-4
FLOATING STEAM VALVES										X	X				V-5, V-6
CONVERTER HWH											X				
CONVERTER STEAM SUPPLY															D.O. ENABLES CONVERTER STEAM VALVES
DDC EMERGENCY BYPASS															
CONDENSATE RETURN PUMPS												X	X		

DIAGRAM NOTE:

1. REFER TO SHEET H5.1.1 THRU H5.1.3 FOR "ECC" INPUT/OUTPUT SCHEDULE.
2. FOR WET SIDE CONTROL LEGEND (TYPICAL) SEE H5.3.1

SHEET NOTE:

(1) TEMPERATURE SENSORS (1) & (2), (8) & (9) SHALL BE CALIBRATED MATCHED PAIRS.



* 1 AT BLDG. 100-EB-135
1 AT BLDG. 101-MAIN MECH.1.1

DCP POINT CONFIGURATION

HOT WATER HEATING HEATING SEQUENCE OF OPERATION

HOT WATER HEATING PUMPS
THE HOT WATER HEATING SYSTEM IS SERVED BY THREE HOT WATER HEATING PUMPS (100-HWP1, 100-HWP2 & 100-HWP3) EQUIPPED WITH VARIABLE SPEED MOTOR CONTROLLERS (VSMC). TWO PUMPS ARE REQUIRED TO MEET THE HOT WATER REQUIREMENTS AND THE THIRD PUMP IS TO BE UTILIZED AS A STAND-BY. THE "LEAD" PUMP SHALL OPERATE CONTINUOUSLY. THE "ECC", VIA THE DCP, SHALL MONITOR THE HOT WATER LOOP DIFFERENTIAL PRESSURE TRANSMITTER AND CONTROL PUMP SPEED AS REQUIRED TO MAINTAIN A DIFFERENTIAL PRESSURE TO BE DETERMINED DURING TESTING & BALANCING AT THE TRANSMITTER WITH THE LOWEST DIFFERENTIAL PRESSURE.

IF THE DIFFERENTIAL PRESSURE SET POINT CANNOT BE MAINTAINED BY ONE PUMP FOR A CONTINUOUS 5 MINUTE PERIOD, THE "ECC", VIA THE DCP, SHALL ENABLE THE SECOND PUMP IN THE "LEAD-LAG" SEQUENCE AND THE SPEED OF BOTH PUMPS SHALL BE EQUALIZED AND CONTROLLED IN PARALLEL TO MAINTAIN SETPOINT. IF THE WATER FLOW (MEASURED THROUGH FLOW METER "WFMD6") IS LESS THAN WHAT ONE PUMP CAN PRODUCE AT 100% SPEED FOR A CONTINUOUS 5 MINUTE PERIOD THE "LAG" PUMP SHALL BE DE-ENERGIZED.

IF AN ENABLED PUMP'S OPERATION IS NOT CONFIRMED BY ITS RESPECTIVE "VSMC'S" KW OUTPUT SIGNAL AND OR THE HOT WATER HEATING FLOW METER (WFMD6), A PUMP FAILURE ALARM SHALL BE REPORTED TO THE "ECC", VIA THE DCP, AND THE NEXT PUMP IN THE LEAD-LAG SEQUENCE SHALL BE ENABLED IF NOT ALREADY OPERATING.

ONCE A MONTH, THE "ECC" SHALL SELECT THE PUMP WITH THE FEWEST TOTAL OPERATING HOURS TO BE THE "LEAD" PUMP IN THE "LEAD-LAG" SEQUENCE.

HOT WATER HEATING SYSTEM CONTROL
THE SYSTEM IS SERVED BY TWO STEAM TO HOT WATER CONVERTERS (100-C1 & 100-C2). BOTH CONVERTERS ARE NEEDED TO MEET HEATING DEMAND. EACH CONVERTER HAS A WATER ISOLATION VALVE (V-1 OR V-2) WHICH SHALL CLOSE WHEN THE CONVERTER IS NOT OPERATIONAL. EACH CONVERTER SHALL BE EQUIPPED WITH TWO STEAM CONTROL VALVES (V-3 OR V-4 & V-5 OR V-6).

WHEN ONE PUMP IS OPERATIONAL, THE "LAG" CONVERTER ISOLATION VALVE (V-2 OR V-1) SHALL BE CLOSED AND THE " LEAD" CONVERTER'S VERNIER STEAM FLOW CONTROL VALVE (V-3 OR V-4) SHALL BE ENABLED FOR AUTOMATIC CONTROL. WHEN THERE IS A SECOND STAGE HEATING DEMAND (TWO HOT WATER PUMPS ARE OPERATIONAL) THE "LAG" CONVERTER'S ISOLATION VALVE (V-2 OR V-1) SHALL BE OPENED AND ITS VERNIER STEAM FLOW CONTROL VALVE (V-4 OR V-3) SHALL BE ENABLED TO OPERATE IN PARALLEL WITH THE "LEAD" CONVERTER'S CONTROL VALVE (V-3 OR V-4).

VERNIER CONTROL
ON A HEATING DEMAND, FIRST THE SMALL STEAM FLOW CONTROL VALVE (V-3 OR V-4) (VERNIER STEAM FLOW CAPACITY) SHALL MODULATE TO MAINTAIN HOT WATER SUPPLY TEMPERATURE SET POINT. IF THE VALVE (V-3 OR V-4) REACHES THE 100% OPEN POSITION, LARGE STEAM VALVE (V-5 OR V-6) (2/3 STEAM FLOW CAPACITY) SHALL SLOWLY POSITION OPEN UNTIL SET POINT IS ATTAINED, AT WHICH POINT IT SHALL MAINTAIN POSITION. IF THE HEATING DEMAND DECREASES, THE MODULATING VALVE (V-3 OR V-4) SHALL POSITION AS REQUIRED TO MAINTAIN SET POINT. IF THE HEATING DEMAND DECREASES TO THE POINT THAT (V-3 OR V-4) ATTAINS THE CLOSED POSITION, VALVE (V-5 OR V-6) SHALL SLOWLY CLOSE WITH SET POINT MAINTAINED BY VERNIER VALVE (V-3 OR V-4).

HOT WATER HEATING SET POINT CONTROL
AFTER THE LEAD PUMP VSMC HAS RESET TO ITS MINIMUM SPEED, THE HOT WATER HEATING SUPPLY SETPOINT SHALL BE VARIED INVERSELY WITH OUTSIDE TEMPERATURE (SEE RESET SCHEDULE) OR BE MAINTAINED AT THE MINIMUM TEMPERATURE THAT WILL SATISFY THE HEATING DEMANDS OF REHEAT ZONES (MONITORED THROUGH THE "ECC" VIA THE DCP).

NOTE: IN THE EVENT OF A DIGITAL CONTROL FAILURE. THE BUILDING HOT WATER SYSTEM CAN BE OPERATED SEMI-AUTOMATICALLY THROUGH ENABLING THE "EMERGENCY DCP BYPASS" SWITCH AND ANALOG BACK-UP CONTROLS LOCATED AT THE HEATING HOT WATER SYSTEM DCP. WHEN THIS BACK-UP MODE IS ENABLED; THE HEATING HOT WATER PUMPS AND CONVERTER SYSTEMS CAN BE ENABLED MANUALLY BY THE FACILITY ENGINEER THROUGH SWITCHES AT THE DCP. HARD WIRED CONTROLLERS SHALL CONTROL BUILDING DIFFERENTIAL PRESSURE VIA THE HOT WATER PUMP "VSMC'S" AND REGULATE THE CONVERTER CONTROL VALVES IN A SEQUENTIAL MANNER.

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